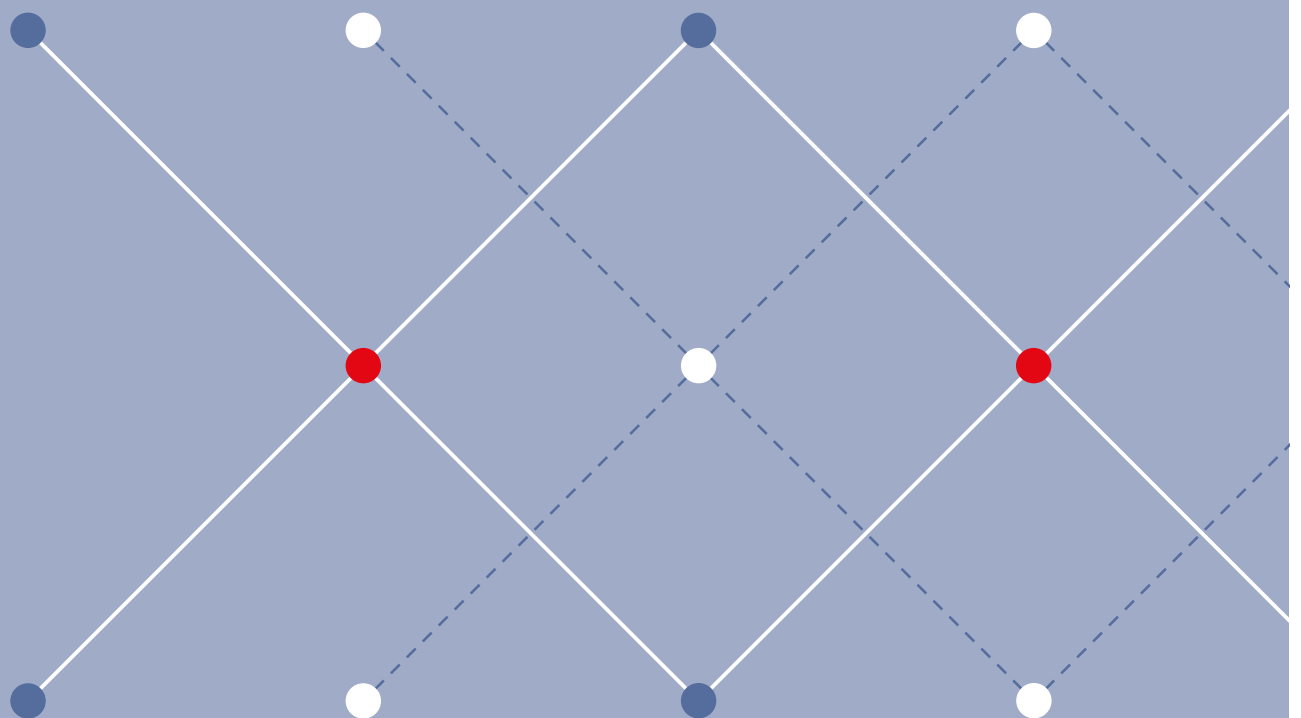


Diversity and Inclusion in Peer Review at **IOP** Publishing

iopscience.org



Contents

Executive summary	3
1. Introduction	5
Peer review at IOP Publishing – how do we do it?	6
2. Methodology	8
3. Results	10
Authors	10
– Gender diversity of authors	10
– Geographical diversity of authors	13
Reviewers	15
– Gender diversity of reviewers	15
– Geographical diversity of reviewers	16
Editorial Board membership	18
– Gender diversity of Board membership	18
– Geographical diversity of Board membership	19
4. Recommendations	21
Providing guidance for reviewers	21
Training for peer-review staff on addressing bias in peer review	21
Training Board Members on implicit bias and reviewer selection	21
Building more diverse and inclusive Editorial Boards	21
Advising authors to consider diversity and inclusion with their reviewer suggestions	22
Invite more women to review	22
Rely less on reviewers from the US and Europe	22
Early Career Researcher Reviewer Recruitment programme	22
Addition of Mx title on submission system	22
Reminder to reviewers to update their user account	22
Encourage authors and reviewers to sign up for ORCID	23
Consider double-blind review on more of our journals	23
Creation of an internal diversity and inclusion statement on peer review	23
5. Limitations	24
6. Conclusions	25
7. References	26
8. Appendix	29
A: Which journals are included in the dataset?	29
B: IOP Publishing Diversity and Inclusion statement for publishing and production	30
– Guiding principles: publishing and production services	30
– Our goals	30
– Continuous improvement: a proactive approach to diversity and inclusion	30
– Governance	30

Executive summary

We believe that our contributors should reflect the diversity of the physical-sciences community, and we recognise that there are inequalities within peer review across the science, technology, engineering and mathematics (STEM) subjects. We acknowledge that diversity leads to better science, in line with the Institute of Physics' aim to advance physics for the benefit of all.

This report captures the current state of diversity and inclusion within peer review at IOP Publishing, based on the data that we have available, compared to related literature. Using gender and geographical data on our authors, reviewers and Editorial Board Members between 2014 and 2018, we identify opportunities for improvement and pose questions that go beyond the capabilities of this report.

We are ahead of the general global trend for female authorship in physics, with 22% of our papers accepted for publication being from women, compared to a global average of just 17% in 2016. Women are generally well represented on our Editorial Boards, most notably in environmental sciences, astrophysics and general physics.

While there are successes, we acknowledge that there are still several areas to be addressed:

- Overall, papers with female corresponding authors have a slightly lower chance of being accepted
- Authors from the US and Europe are more likely to have their papers accepted than authors from China or India
- Male reviewers are invited more frequently than female
- There is an over-representation of invited reviewers from the US and Europe
- Older journals tend to have less diverse Editorial Boards
- There is an under-representation of Editorial Board Members from China and India

We are committed to diversity and inclusion, and this report sets out a number of recommendations both for IOP Publishing and the wider physics community to help accelerate the pace of change with regard to gender and geographical representation. The Institute of Physics has a strong Diversity Programme with the aim of cultivating an inclusive, sustainable, diverse and vibrant physics community. Just recently world-renowned astrophysicist and former President of the Institute of Physics, Professor Dame Jocelyn Bell Burnell has announced that she will donate winnings from her Breakthrough Prize in Fundamental Physics to the Institute for the running of graduate studentships for people from under-represented groups. We hope that through this report and our recommendations that we will be able to support the Institute in its mission to create a more diverse and inclusive physics community. Some examples include building more diverse Editorial Boards, training staff and Editorial Board Members on implicit bias, and inviting more women to review.

We look forward to being change agents for better diversity and inclusion within peer review and the broader physics community, and encourage other researchers, societies and businesses engaged with peer review to join us in our mission to create positive change.

This project was led by Kim Eggleton of IOP Publishing, with considerable support from Bethan Davies, Chris Wileman, Jason Wotherspoon, Frédérique Swist, Alison Tovey, Alison Gardiner and Emily Heming. We thank members of the IOP Publishing leadership team for their contributions and guidance in the creation of this report, in particular Antonia Seymour and Marc Gillett. We also thank Jeni Dyer and Angela Townsend from the Institute of Physics for their inspiration and support in our diversity and inclusion mission. For further information, please e-mail publishing@iop.org.

1. Introduction

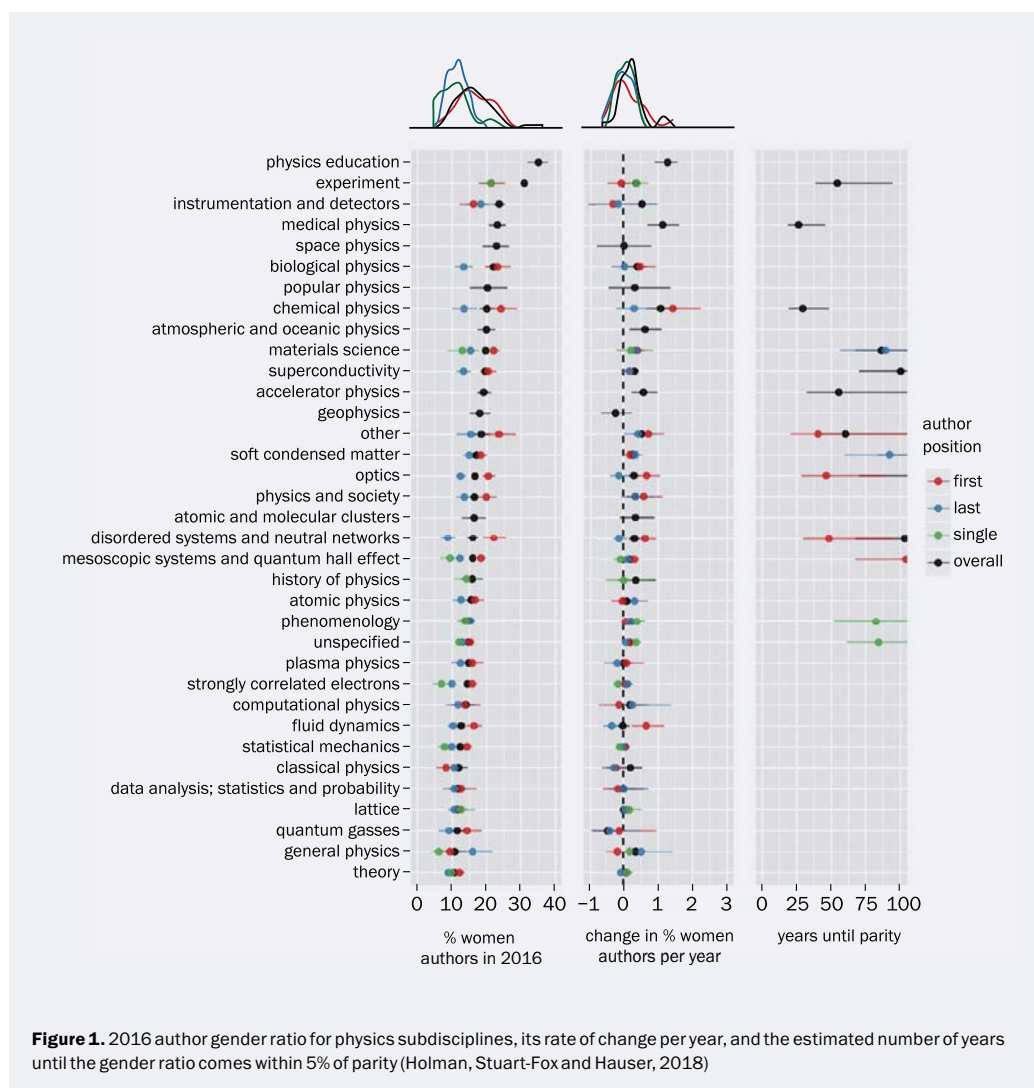
Diversity and inclusion leads to better science, as well documented by scholars (Medin and Lee, 2012; Freeman and Huang, 2015; Bear and Williams Woolley, 2011). It is part of our role as publishers to ensure that anyone producing scientifically rigorous work should be assessed independently of their identity, socio-economic or educational background. With the 2018 of Peer Review Week theme being Diversity and Inclusion, we took the decision to thoroughly analyse how we were doing against our aims to be truly impartial and representative in peer review.

A recent paper by Holman, Stuart-Fox and Hauser (2018) discussed the gender gap across the STEM workforce. They found that topics such as physics had the fewest women authors and were showing little signs of growth (figure 1, p6). The authors posit a number of potential reasons for this, including the suggestion that male-dominated fields, such as physics, attract fewer women graduates, and the problems of the “leaky pipeline” (women are more likely than men to leave STEM careers before progressing to senior positions). *Nature* also reported an under-representation of women as both authors and reviewers in 2018 (*Nature*, 2018).

We were keen to see how our authorship data compared – would we be ahead of the 17% of female authorship identified by Holman, Stuart-Fox and Hauser (2018) in 2016, and what actions could we take to improve the rates of female representation in the physical sciences?

Gender wasn’t the only demographic that we were interested in studying. We work with authors, reviewers and Editorial Board Members from all over the world, and previous studies have shown that there is often a positive bias towards research from the US and Europe (Pinholster, 2016; King, 2004; and Espin *et al.*, 2017). We were curious to understand if that was the case on our own journals, and if the reviewers and Editorial Board Members that we were using were representative of the global physics community.

This report explains the current peer-review practices at IOP Publishing and looks at the gender and geographical data on our authors, reviewers and Editorial Board Members. It also provides several recommendations for IOP Publishing and our communities to better represent the diversity and differences that make up the physical sciences.



Peer review at IOP Publishing – how do we do it?

Peer review has been at the core of scientific research for several hundred years, and is the means by which research is judged and assessed to ensure that it meets the standards for publication. Whilst debate rages about the various methods of peer review and which is the “best”, peer review is still deemed essential to ensuring that only papers that are scientifically valid make it to publication. Traditionally, peer review is conducted by at least two of the author’s peers, sometimes anonymously, who provide critique of the research and suggestions for improvement. It is common for reviewers to outright reject papers or require that numerous revisions are made before papers are accepted for publication.

IOP Publishing is a scientific publisher and a subsidiary of the Institute of Physics, a non-profit membership society working to advance physics for the benefit of all. We publish more than 50 of our own journals, as well as additional titles on behalf of society partners. We also publish books, conference series and magazines.

At IOP Publishing we pride ourselves on a high standard of peer review across all our journals. Articles are only sent out to reviewers if they pass initial desk checks, which include making sure the article is understandable, in the style of a scientific article and within the scope for the journal. We also run all new submissions through plagiarism-checking software, to ensure that reviewers' time isn't wasted on articles that are unsuitable for publication. Research papers are typically sent to two independent reviewers who are asked to report on the quality, scientific rigour, novelty and significance of the paper. Reviewers are selected from our database by our team of experienced in-house editors, and we try to find the best combination of scientific expertise and experience for each paper. Reviewers are checked for conflicts of interest, and we typically find ourselves inviting between 5–8 reviewers per paper to get two reviewers to report (IOP Publishing, 2018a).

Our reviewer database is made up of previous authors and reviewers, as well as author-suggested reviewers, and reviewers that add themselves voluntarily via the submission system (ScholarOne Manuscripts™). We also use a tool (Reviewer Locator) in our submission system to help us identify potential reviewers if we cannot find anyone suitable in our own database. This tool searches Web of Science and returns the results of people that have authored related work in the past.

IOP Publishing journals are international in both authorship and readership, and we aim to give unbiased consideration to all manuscripts offered for publication regardless of whether or not the authors request publication on an open access basis, and regardless of the race, gender, religious belief, ethnic origin, location, citizenship, political philosophy, sexual orientation, age or reputation of the authors.

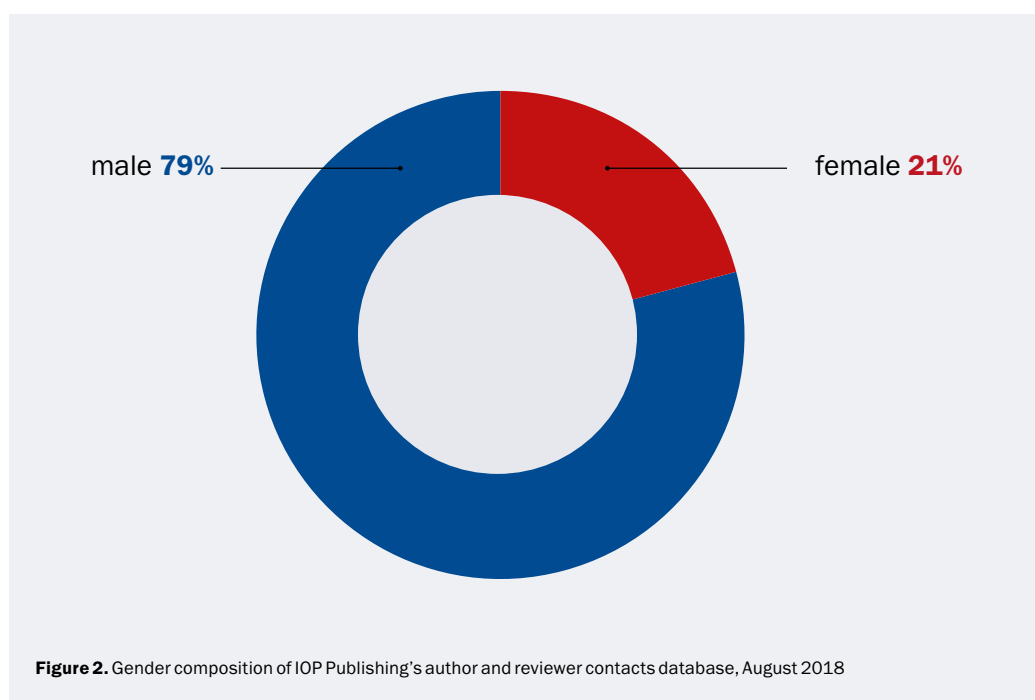
The majority of IOP Publishing journals operate a single-blind peer-review system, where the identities of the reviewers are concealed to the authors, but the reviewers can see the author identities. In 2016, we surveyed our contributor communities and established that there was a small but significant appetite for double-blind review (IOP Publishing, 2016). As such, in 2017, we began offering authors the option of single- or double-blind review on two of our journals, *Biomedical Physics and Engineering Express* and *Materials Research Express*. Since then, we have seen an average of 20% of authors choose the double-blind route, with most authors who took up the option reporting that they saw it as fairer than single-blind (InPublishing, 2018). Other studies have also reported that double-blind is perceived to mitigate inequities (Murray *et al.*, 2018; Kmietowicz, 2008).

2. Methodology

At IOP Publishing we only collect the data that we require from our authors, reviewers and Editorial Board Members, which does not include gender, age, race, religion etc. The only data that we have on our contributors are their name, e-mail, institution and country, and any submission, publication or reviewing record that they have with our own journals (see AppendixA, p29). This data is all held securely on our submission system (ScholarOne Manuscripts™). We began using this system during 2013, so for the purpose of this report we are analysing data from 2014 to the present day (August 2018).

Accounts within the database are usually created by the users themselves, therefore any data relating to institution, country or title is self-reported. Occasionally, accounts are created by other users, who may be registering a co-author or suggested reviewer. We do not actively monitor any accounts to keep them up to date.

As gender is not recorded, we elected to use the Genderize API (<https://genderize.io/>) to help us assign gender to a user's first name. The gender data has been kept separately from our user accounts and no gender data has been stored against any of our users. Our contact database contains approximately 640,000 contacts with first names. We were able to assign genders to just over 421,000 (66%) of the contacts database using Genderize. This number falls to 256,000 (40%) when we apply certainty limits to the assigning of the genders. The resulting gender spilt of our contact database (including certainty limits) is 79% male and 21% female.



ScholarOne Manuscripts™ database geographic distribution

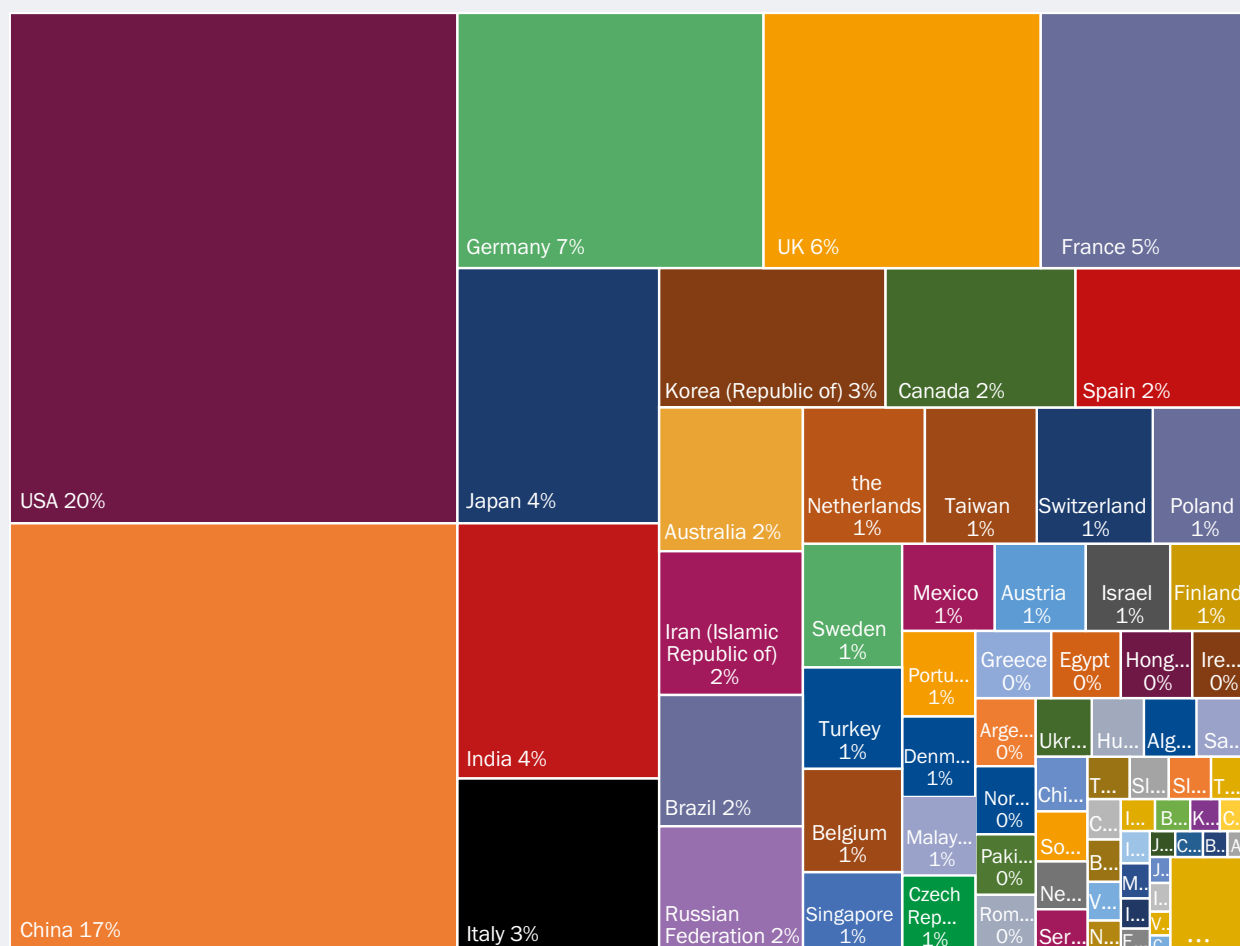


Figure 3. Geographical composition of IOP Publishing's Author and Reviewer Contacts Database, August 2018

All contacts in our database must be linked to a country from the official ISO List of Country Names and Code Elements (ISO 3166-1). Figure 3 shows the count of entries on our database by country at August 2018.

3. Results

Authors

IOP Publishing receives thousands of submissions every year from authors across the globe. Many papers are written by groups of authors, but for the purposes of this report we are just looking at the corresponding author for each paper, as including all co-author data would lead to increased weighting for those articles with multiple authors. Author accounts within the database are usually created by the authors themselves, therefore any data relating to institution, country or title is self-reported.

Gender diversity of authors

The gender split of submitted articles (2014–2018) is 22% female and 78% male (figure 4), and very similar to our overall database demographics (figure 2, p8). This is higher than Holman, Stuart-Fox and Hauser (2018) found, which is promising. We have seen a slow increase in submissions from female corresponding authors since 2014, with a peak in 2018 YTD at 27% of submissions coming from female corresponding authors (figure 5). The number of accepted articles for female corresponding authors follows the same pattern, although there is a consistent difference of 1% every year between submissions and accepts, with this gap growing considerably in 2018. Given the average length of time articles spend in the peer-review process median (81 days in 2018 – IOP Publishing, 2018b), we may see this gap lessen by the end of the year/early 2019.

What is the gender split in IOP submissions?

Percentage of submissions to IOP which are from male and female corresponding authors

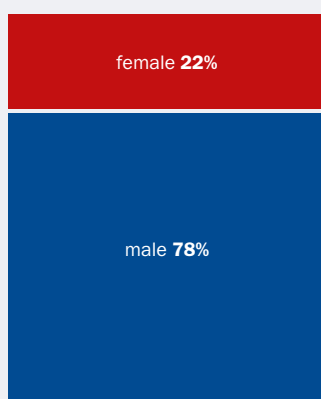


Figure 4. The overall gender split for submissions to IOP Publishing journals, 2014–2018

How has the gender composition of submissions and accepts changed?

Submissions split by male and female corresponding authors

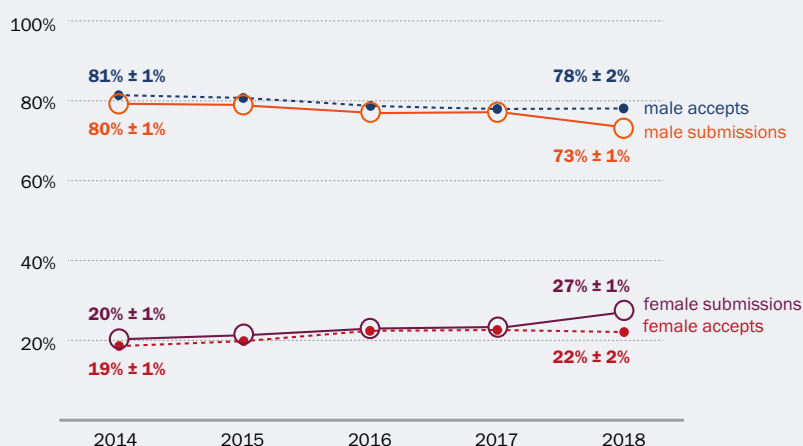
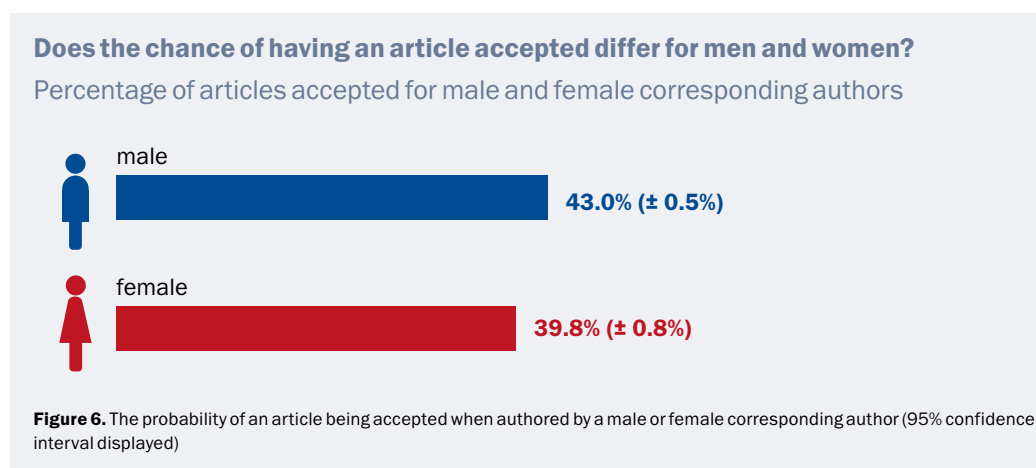
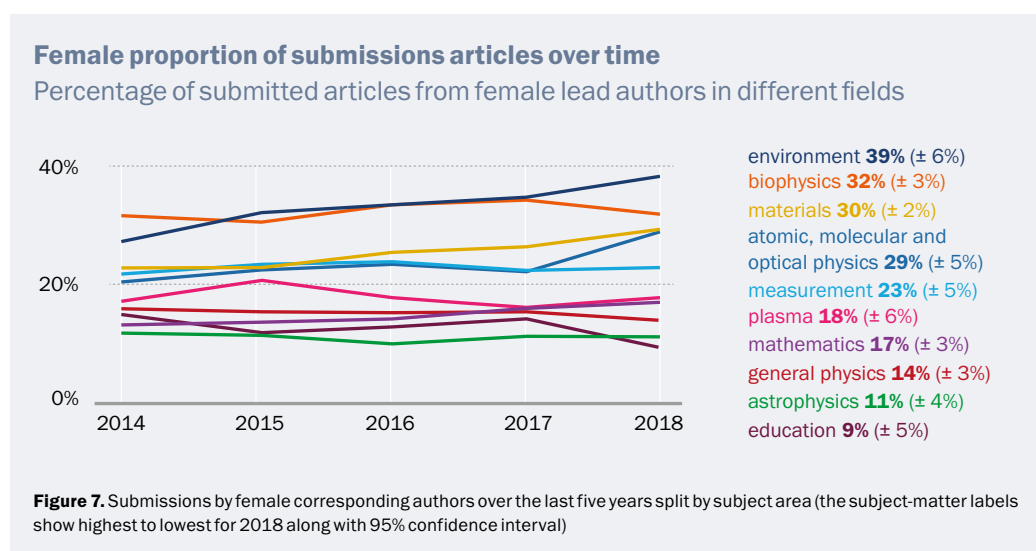


Figure 5. Development percentages of submissions which are from female and male lead authors over the last five years (2018 data is up to August)

This led us to look at the probability of being accepted for female or male corresponding authors. Papers with male corresponding authors have accept rates of 43%, compared to female corresponding authors who have accept rates of 40% (figure 6). Other analyses have also found lower success rates for female authored papers (Murray *et al.*, 2018; Wenneras and Wold, 1997); however, it must be stressed that we do not know the reason for this. The cause could be that the overall seniority differs significantly between the genders with the decline of female researchers as seniority increases (the “leaky pipeline”). Given that we use mostly single-blind peer review, it could also be argued that reviewers and editors are more inclined to accept papers from more senior faculty believing them to be higher quality, despite research that suggests career age negatively affects the quality of work (Ebadi and Schiffauerova, 2016).



Despite female authorship increasing across our broad portfolio, we were interested to see if there were differences between the subdisciplines of physical sciences that IOP Publishing covers. Our analysis shows that female corresponding authorship is increasing in almost half of IOP Publishing’s subject areas (figure 7), in line with global trends reported by UNESCO (UNESCO, 2018) and Elsevier (Elsevier, 2017). The lowest female participation in IOP Publishing submissions is in astrophysics, education and general physics.



Similar patterns can be seen when looking at accepted articles (figure 8), with the lowest proportion of accepted articles from female corresponding authors being in general physics, astrophysics and education. Biophysics is the anomaly in these figures, as the data suggests that while submissions from female corresponding authors was on the increase until 2018, the number of accepted articles from female corresponding authors started to decline earlier in 2017.

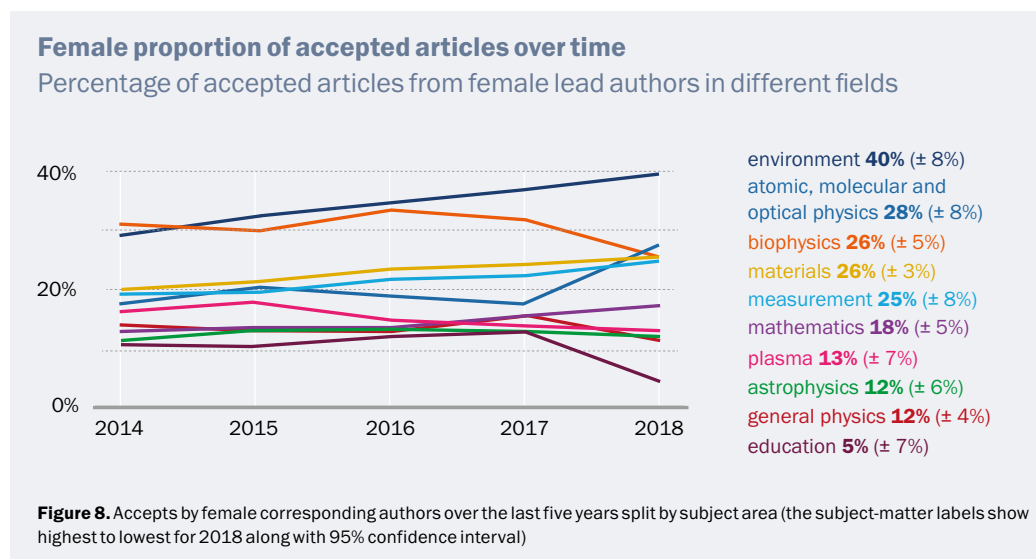
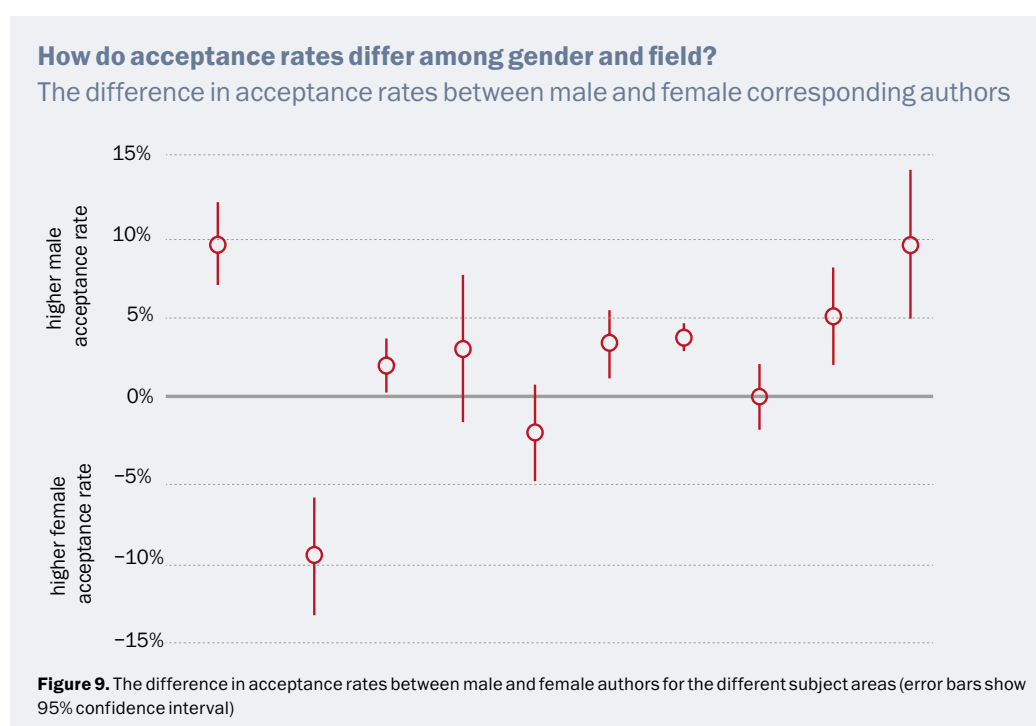
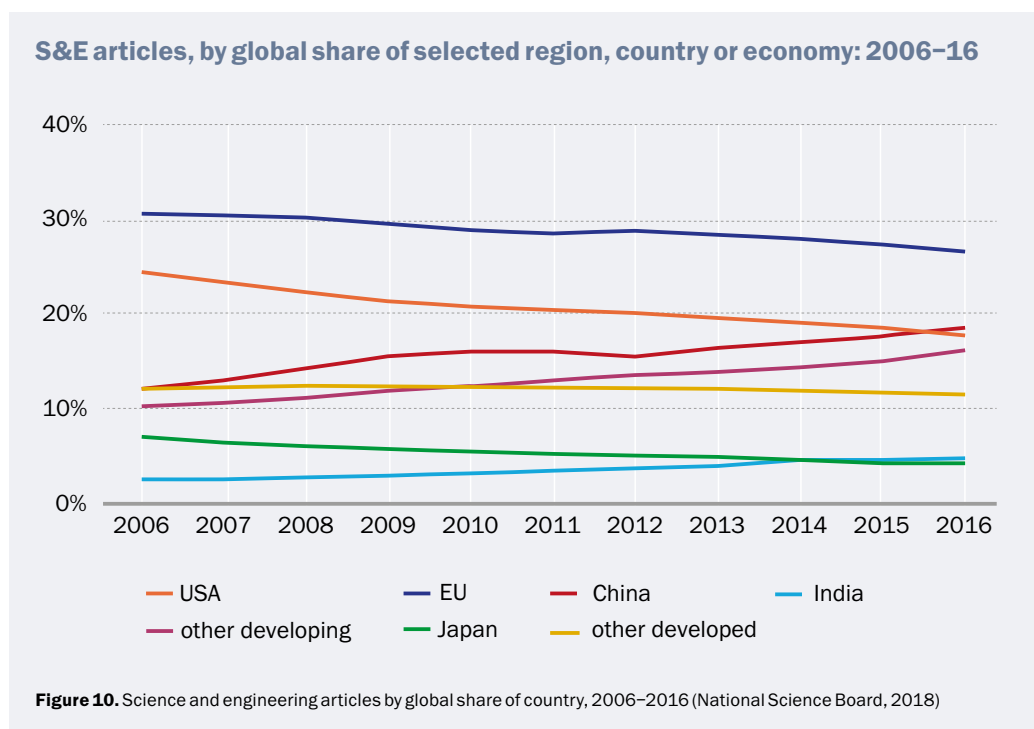


Figure 7 (p11) and figure 8 also allow us to compare the acceptance rates by sub-discipline. In this respect, we can see that five of the subjects have a lower acceptance rate for female authors compared to male, with biophysics, education, environment and mathematics being consistent with equal probabilities for each gender at the 95% confidence level. However, in astrophysics, where there appear to be marginally higher chances for female corresponding authors to be accepted than males (figure 9).

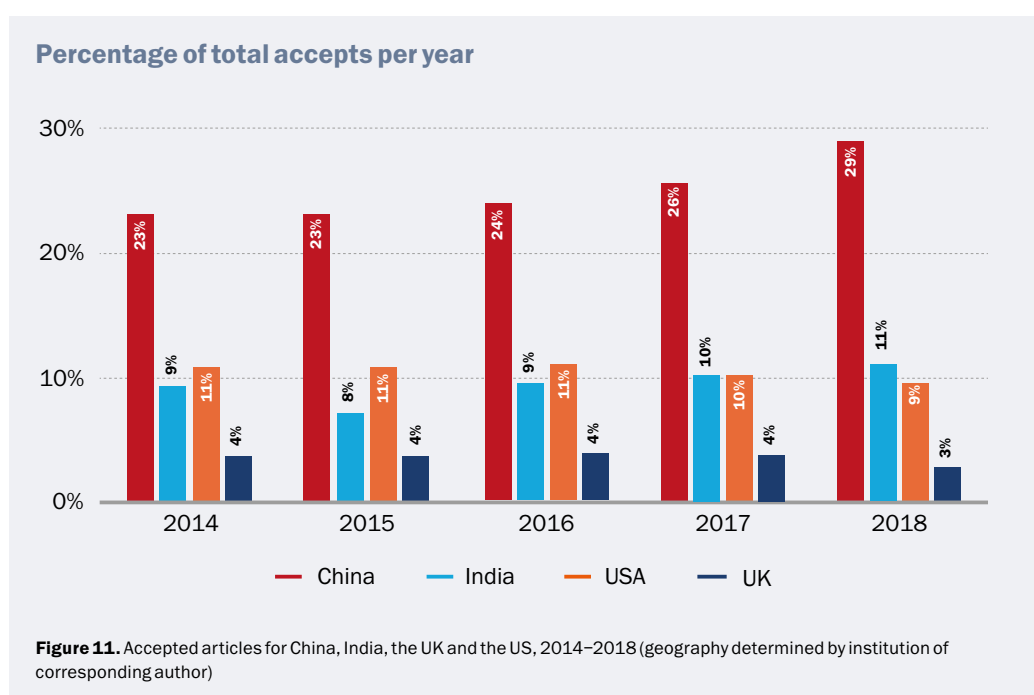


Geographical diversity of authors

The geographical face of authorship has changed significantly in the last five years, with a traditional Western (USA and Europe) led majority being gradually overtaken by the booming Eastern economies of China and India (figure 10).



The same is true for IOP Publishing's journals, with the differences in accepted articles in just the last five years becoming quite pronounced (figure 11).



Submission lead authors

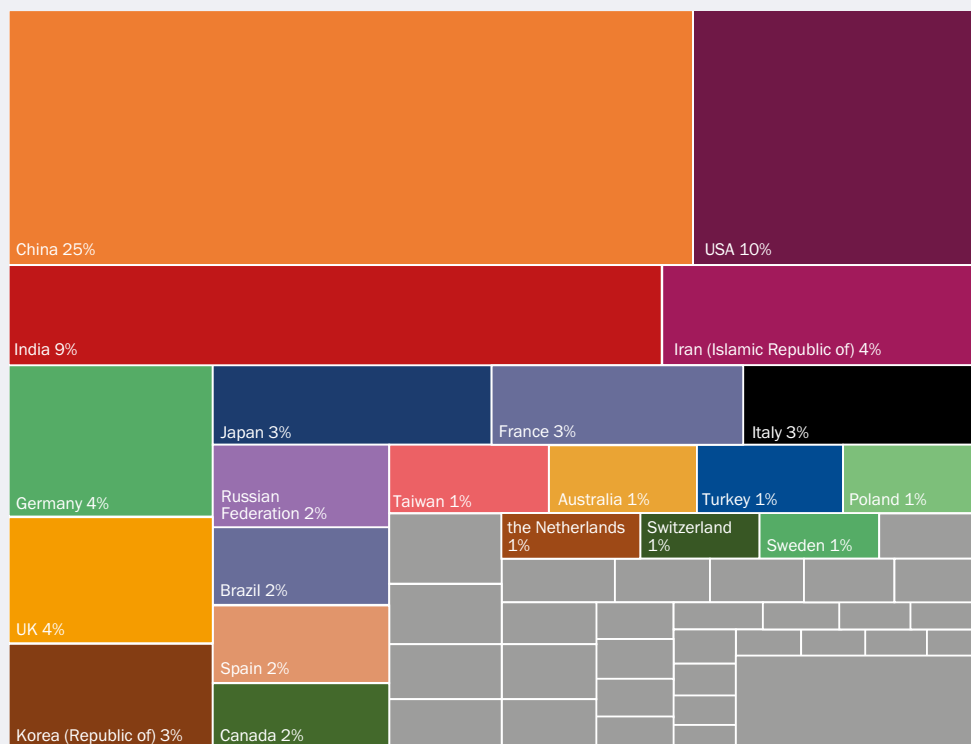


Figure 12. Submissions by country of corresponding author, 2014–2018

Accepts lead authors

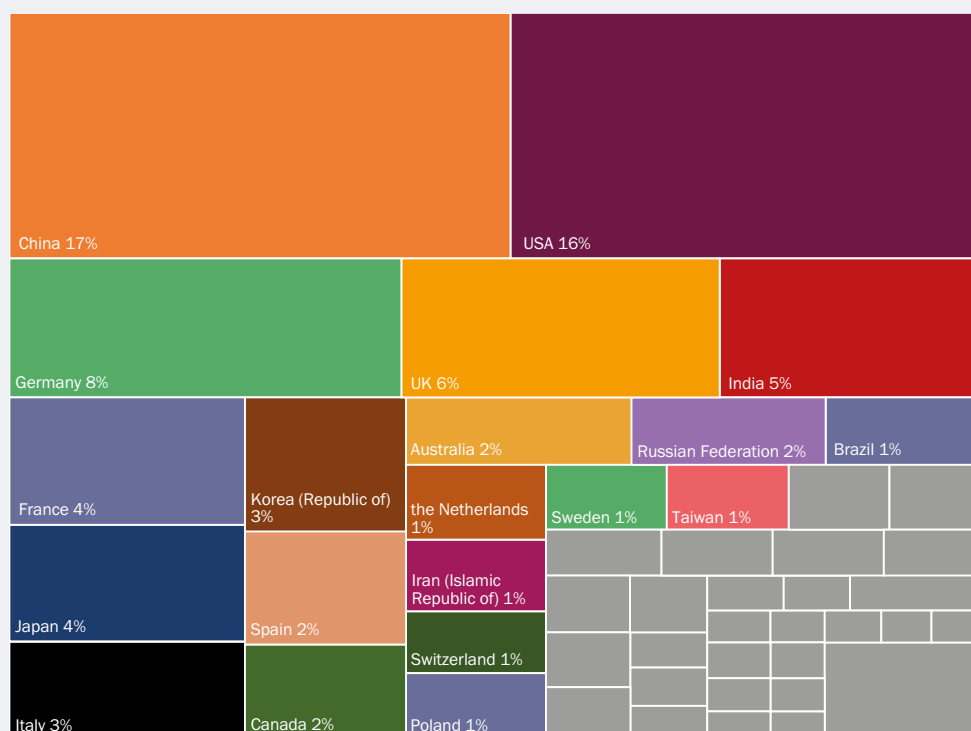


Figure 13. Accepts by country of corresponding author, 2014–2018

Figures 12 and 13 (p14) show the overall submission and accept rates by country from 2014–2018. While China is responsible for the highest proportion of submissions to IOP Publishing journals at 25%, it is only responsible for 17% of accepts. In comparison, the US contributes only 10% of submissions and yet is responsible for 16% of all accepted articles. This supports the results from the recent *eLife* study, which showed over-representation for the US, UK and Germany, while China was under-represented (Murray *et al.*, 2018). As figure 11 (p13) shows, more articles from China and India have been accepted year on year at IOP Publishing, suggesting an improvement in quality of research output from these regions, as supported by the literature (Jia, 2017; Xie, Zhang and Laia, 2014; Huggett and Goodchild van Hilten, 2016).

Reviewers

Reviewers perform an integral role in the peer-review process and scientific literature only grows through participation in peer review. Reviewers need to be representative of the broad subject community to ensure fair review. Acting as a reviewer can also lead to recognition for merit and promotion, so it is vital to take an inclusive approach when inviting reviewers.

Gender diversity of reviewers

There is a growing body of literature that suggests not enough women are being invited to participate in peer review. Women of all ages are used less often as reviewers compared to their male counterparts, and proportionally less than their publication records should suggest (Fox, Burns and Meyer, 2016; Helmer *et al.*, 2017; Lerback and Hanson, 2017). Analysis of our own database supports this research, and we find that despite 21% of our contacts database being female, only 15% of invitations to review are sent to women (figure 14). This equates to our male reviewers being invited 4.38 times over the 2014–2018 period, but female reviewers only being invited 3.89 times over the same timeframe. We also found that there was a small, but statistically significant, propensity to invite female researchers to review only once. *eLife* found similar results, with only 21% female reviewers compared to 26% of female corresponding authorship (Murray *et al.*, 2018).

Reviewer invitations by gender

Percentage of invites sent to female and male reviewers

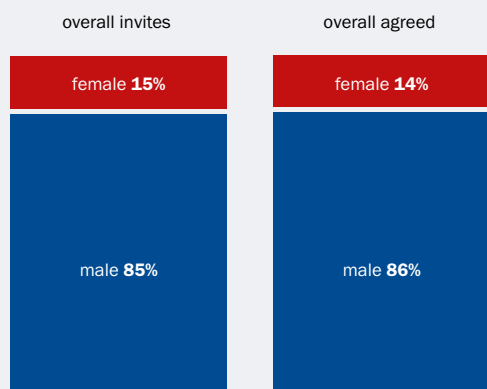


Figure 14. Reviewer invitations by gender, 2014–2018

How likely is it that a male/female contact will agree to review?

The percentage of invites that result in an agreement to review an article

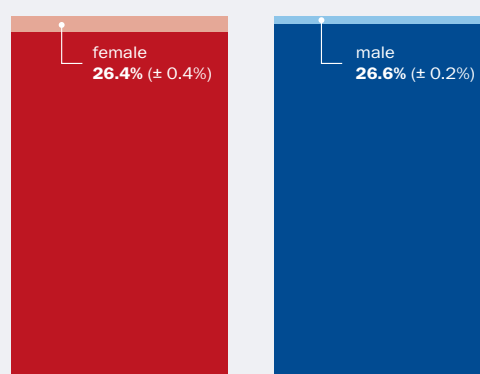


Figure 15. Likelihood to accept an invitation to review, by gender, 2014–2018

To investigate further, we looked at whether female reviewers were more likely to decline an invitation to review, which previous studies have disproved (Fox, Burns and Meyer, 2016; Helmer *et al.*, 2017; Lerback and Hanson, 2017). We also found no significant difference in the propensity for men or women to accept review invitations, supporting the Helmer *et al.* (2017) suggestion that “simply increasing the number of invitations to female reviewers would have a direct and proportional effect”.

Despite the percentage of female reviewers increasing by 3% in the last five years, it is increasing at a slower rate than in female submissions (7%). This suggests that there is work for us to do when considering who to invite to review submissions, and that we should be making a conscious effort to increase the number of invitations to female reviewers.

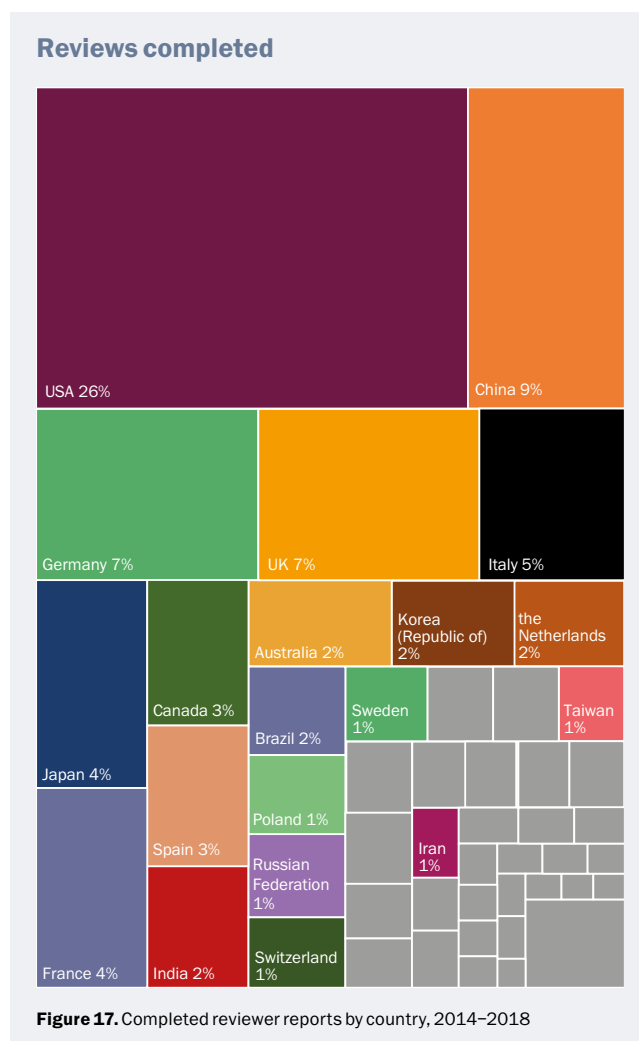
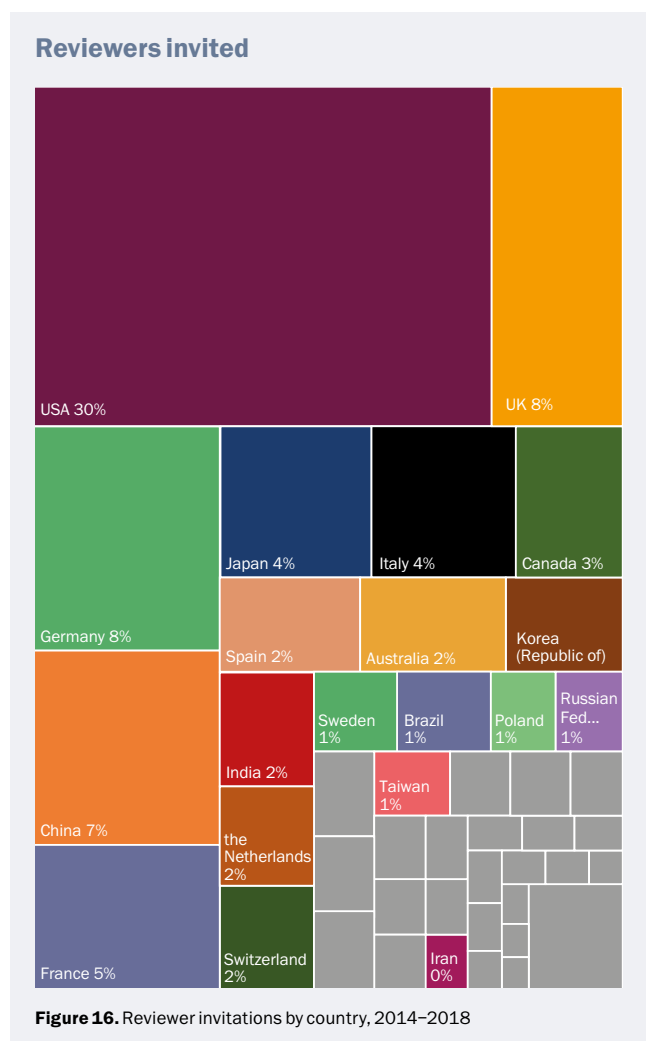
The higher rate of male reviewers compared to female could also explain the higher accept rate for male corresponding authors, as (Murray *et al.*, 2018) discovered, all-male reviewer panels are significantly more likely to accept papers by male authors.

Geographical diversity of reviewers

While the geographical change in authorship is well documented across the scholarly publishing literature, we wanted to investigate whether the changes were also reflected in the reviewers that we invite (figure 16, p17). Here is where we see the biggest difference of this whole study. Despite only 16% of accepted papers being from US authors, we are inviting reviewers from the US 30% of the time. Compare this to China, from where we only invite 7% of reviewers despite 17% of accepted papers coming from corresponding authors in China. Similar (though not as extreme) differences were also found for the UK and India.

We then went on to look at the geographical representation of reviewers that accept an invitation and complete a report (figure 17, p17), in case that was influencing our choice of invitation. This not only shows any geographically proportional disparities between authors and reviewers, but also which reviewer countries are likely to accept an invitation to review. Reviewers from China fared very well, despite being only 7% of all reviewers invited, they make up 9% of all completed reviews. Compare this to the US, where 30% of all reviewer invitations are sent, yet they only make up 26% of completed reviews. This suggests a reviewer in China is more likely to accept and complete a report than a reviewer in the US. This would reflect the fact that we are inviting reviewers from the US more frequently than China and suggest that US reviewers must be more selective in the invitations that they accept, as they are more in demand. Perhaps if we invited a broader geographical spread of reviewers, reviewers from some countries wouldn't feel as burdened and others would have more of an opportunity to build their reviewing profiles.

Research has also suggested that US reviewers are more likely to provide favourable reports on articles written by authors from the US (Link, 1998), or more likely to recommend a paper for acceptance if they share demographic characteristics with the authors (Murray *et al.*, 2018). This may go some way to explain the continually high acceptance rate for US and European corresponding authors, as many of the reviewers that we invite are from the same countries and have a bias towards demographics that mirror their own.



As editors and publishers, we have a question to ask ourselves when so many of our submissions are coming from countries such as China, India and Iran – why are we not asking these same people to review? Is it bias? When talking to editors they often argue that potential reviewers from Asia and Asia-Pacific don't have enough of a reviewing history compared to those from the US or Europe. But this creates a catch-22 situation, how will their reviewing credentials ever build up if we don't invite them to review? It is recommended practice on IOP Publishing journals to only invite reviewers that have attained their PhD. While we have access to the reviewing history of our contacts on any of our journals, we don't have their academic qualifications, other than what the user selects as a title (e.g. Professor, Dr), and how up to date they have kept their account. We're therefore unable to make any judgement on whether there are more "qualified" reviewers in some countries than others, although at last count, OECD has more than two-million active researchers in China in 2012, the highest of all countries recorded (OECD, 2018). Could it also be that researchers with Chinese names are harder to disambiguate, therefore we can be less confident in their publication history? This is something that is often checked when selecting reviewers, so it would be beneficial for users to associate their accounts with a unique identifier (ORCID, for example), so we are able to distinguish better between individuals.

Editorial Board membership

The role of the Editorial Board Member can vary greatly between journals, but at IOP Publishing the Board Members typically fulfil five main functions:

- Representatives of the subject community that the journal serves
- Key influencers of strategy for a journal, making decisions about scope and coverage that represent the community
- Senior reviewers in difficult peer-review cases, taking an adjudicator role in instances of reviewer disagreement
- Sources of consultation for publication misconduct or ethical issues
- Networkers for the journal, getting out into the community and soliciting high-quality submissions on exciting topics

Board Members on some of our journals also play a very active role in peer review, often doing the initial desk check, selecting reviewers and making decisions on the suitability of articles.

As an important part of any journal's identity and structure, we work with research communities to best represent the fields specific to each journal, believing that our Editorial Boards should reflect the diversity of the communities that they serve.

Gender diversity of Board membership

In 2018, across all IOP Publishing journals, women account for 22.5% of Board Members, which in comparison to the make up of our database (figure 2, p8) seems broadly in line. It is also similar to figures given by other publishers in related fields, for example, a recent Royal Society of Chemistry report revealed that their Publishing Editorial Boards are 24% female and their Publishing Advisory Board Members are 18% female (Royal Society of Chemistry, 2018). A 2011 study revealed 17.5% of Editorial Boards on medical journals were women (Amrein *et al.*, 2011).

Percentage of female Board Members per subcategory

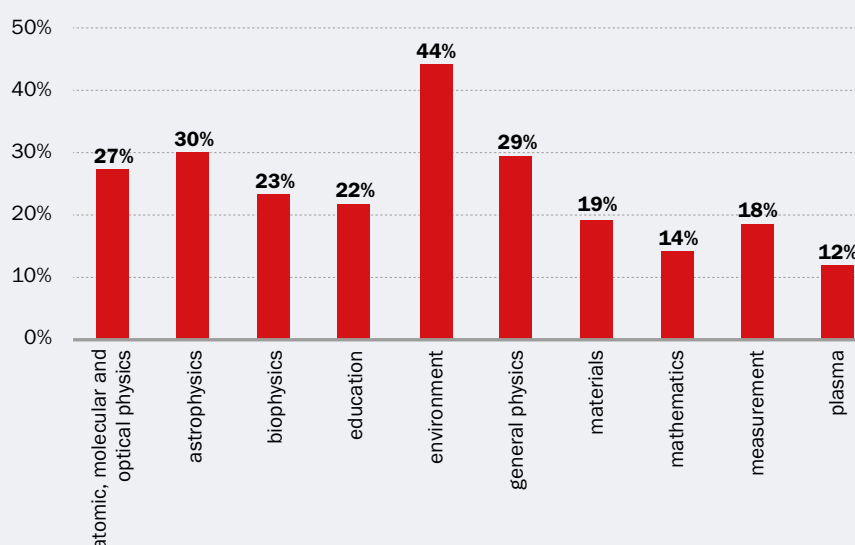


Figure 18. Proportion of female Board Members by subdiscipline

When we break the IOP Publishing result down by subdiscipline however (figure 18, p18), we see wide variation between subjects, with low representation in plasma and mathematics, and high representation in environment and astrophysics.

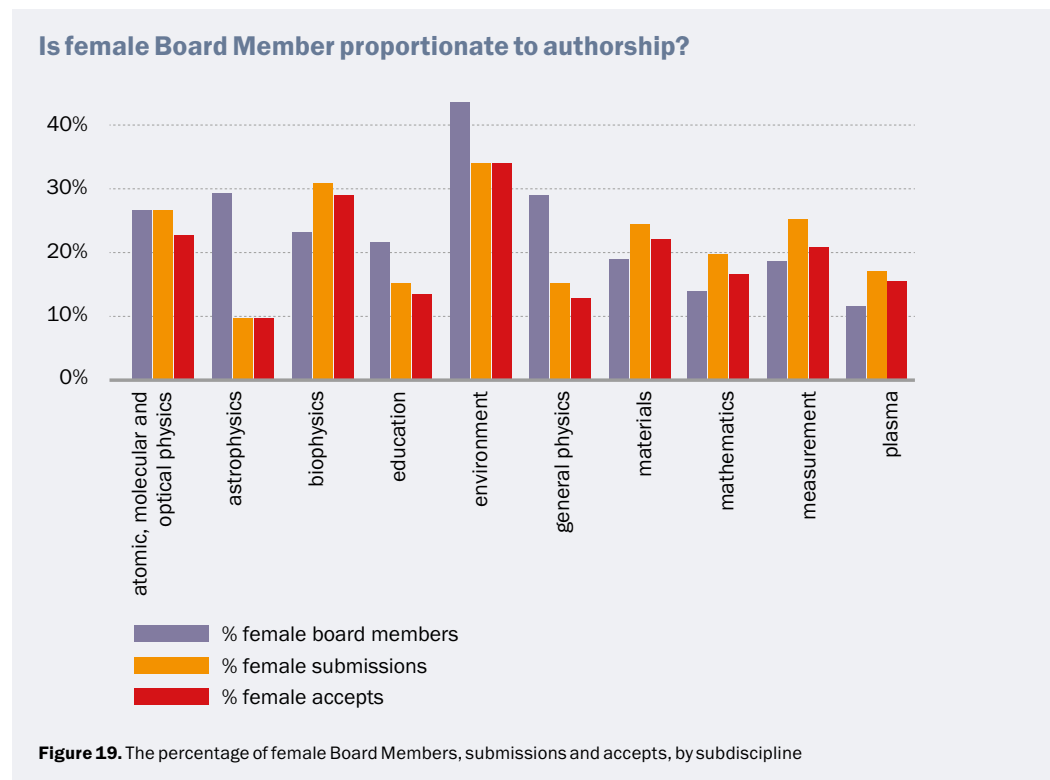


Figure 19 also compares the proportion of female Board Members with the proportion of submissions and accepts from female corresponding authors. Astrophysics, education, environment and general physics all have a greater percentage of female Board Members than submissions or accepts, whereas fields such as biophysics, materials, mathematics, measurement and plasma have Boards that are considerably under-represented when compared to their respective authorship bases. Could this be contributing to the higher acceptance rates for female corresponding authors in environmental sciences and astrophysics, seen in figure 9 (p12)?

One interesting piece of analysis shows that the older a journal is, i.e. the earlier it was founded, the smaller the female Board component is. This suggests that when the Boards were originally created, they may have been more representative, but as female authorship has increased, the diversity of our Boards have not continued to reflect the make up of the communities that they serve.

Geographical diversity of Board membership

Looking at the make-up of our Editorial Boards including editors and associate editors (figure 20, p20), just like our reviewer selection, the US and UK are significantly over-represented in comparison to the proportion of submissions that we receive from these regions. Germany and France also have higher proportions of Board Members compared to submissions. Perhaps unsurprisingly, China is significantly under-represented, as are

India and Iran. Is this just a throwback to the fact that submissions coming from these countries have only increased in recent years? We posited the idea that the research communities in China and India are still young in comparison to the US and Europe, and when looking for new Board Members we would typically look for someone well established in their career with an excellent publication history and good networks within the community. With the surge in Chinese and Indian authorship only happening in the last few years, is there an argument to suggest that there aren't as many researchers at that "top flight" level from Asia and Asia-Pacific yet? The contrary point to this is that the sheer size and population of researchers in China and India should mean a numeric advantage. Or perhaps this is down to perceived quality of scholarship from these countries, proven or otherwise. The 2018 World University rankings for physics and astronomy are still heavily dominated by US and European institutions (*Times Higher Education*, 2017). Another reason could be that we ask existing Board Members to suggest new potential Board Members, who may well be recruiting in their own image, or are not as well networked outside their own country, creating a Matthew Effect (Merton, 1968).

Board Members by country

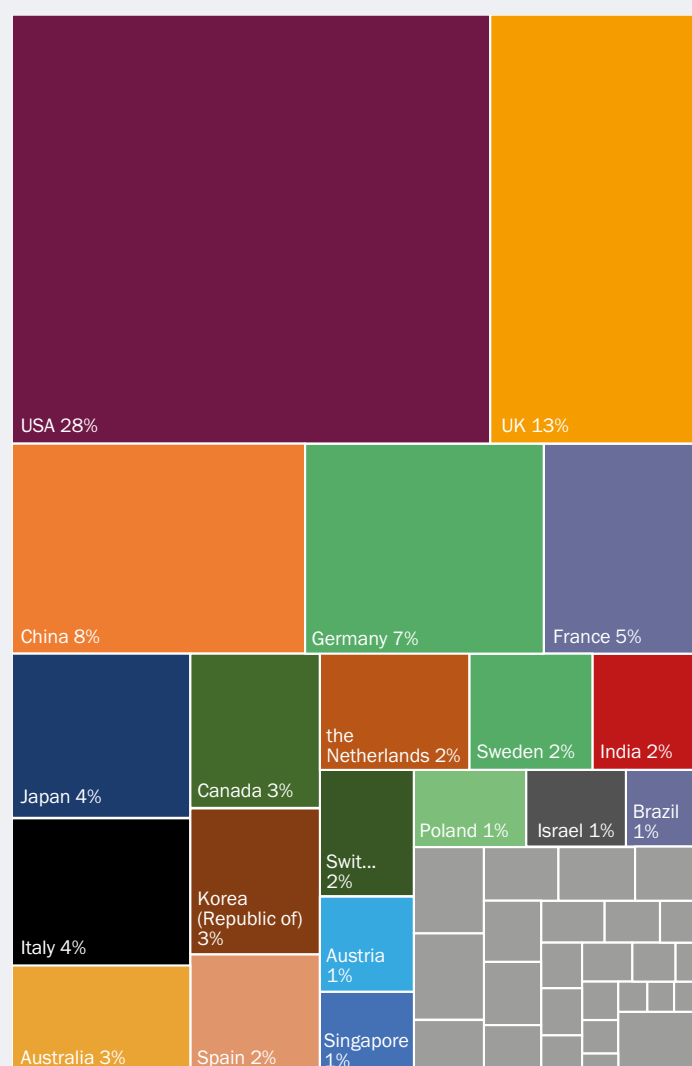


Figure 20. Geographical representation of Board Members at August 2018

4. Recommendations

The findings of this report highlight several questions and problems. For example, why are we inviting fewer female reviewers than is proportional to the database? Why do we seem to favour reviewers from the US over China? Why have our journal Editorial Boards not been modified to reflect the changing demographics of the subject communities that they serve? While we can make some suggestions, none of this analysis proves any causal relationship, so conclusions must be drawn tentatively. That said, we are committed to doing whatever we can to reduce bias in peer review and therefore have already taken, or plan to take, the following actions to improve our representation both in terms of gender and geography. These are listed in no particular order:

Providing guidance for reviewers

While we have long asked reviewers to declare any conflict of interest before accepting an invitation to review, we have not been offering any advice to reviewers on how to avoid any of their own implicit biases when assessing papers. We have recently introduced some new guidance on our website and in our reviewer guides (see <https://publishingsupport.iopscience.iop.org/questions/implicit-bias/>) which is a first step to help reviewers eliminate their own biases when assessing papers. We are also directing reviewers to the Publons Academy (<https://publons.com/academy>), a free and practical peer-review training course for early career researchers with a module that covers author and reviewer biases, conflicts of interest, and misconduct. We have also incorporated information on implicit bias in the reviewer training that we run at conferences and institutions.

Training for peer-review staff on addressing bias in peer review

Recognising that everyone has bias, whether conscious or unconscious, we recently invited a consultant to run several workshops on bias for our publishing staff. These workshops were mandatory for any staff directly involved in peer review, and optional for others working in related departments. These sessions were well received and provided a useful forum for staff to learn about, and discuss, the various aspects of bias in peer review, including prevention methods.

Training Board Members on implicit bias and reviewer selection

As noted earlier, our Editorial Board Members can often be involved in the peer-review process and will be involved with suggesting and inviting reviewers. Just as with our own staff, we intend to encourage our Board Members to recognise where there may be implicit bias at play and try to select more diverse and representative reviewers.

Building more diverse and inclusive Editorial Boards

This report has shown that our Editorial Boards are not reflective enough of the communities that the journals represent. We will work hard to make sure that there are more women on our Editorial Boards and that the geographic regions we receive submissions from are also more proportionally represented.

Advising authors to consider diversity and inclusion with their reviewer suggestions

IOP Publishing have always given authors the opportunity to list suggested or opposed reviewers when submitting their paper. We will soon be asking authors to consider diversity when making suggestions, and hope that this will help us broaden our own database, and therefore the reviewers we invite to report.

Invite more women to review

Women are just as likely to accept an invitation as men, and yet we are not inviting them in proportion to their representation on our database. A clear action for us is to invite more women to review papers for IOP Publishing, which should improve the number of women reviewers and potentially the accept rates for papers from female corresponding authors.

Rely less on reviewers from the US and Europe

It is clear from this report that we are over-relying on reviewers from the US and Europe, when we should be using more reviewers from Asia and Asia-Pacific regions. Not only are researchers from these regions more likely to accept an invitation to review, there is also evidence to suggest that this will help improve accept rates for corresponding authors from these regions.

Early Career Researcher Reviewer Recruitment programme

Due to the size of our own database and tools such as Reviewer Locator, we have rarely made marketing attempts to recruit more reviewers. Recognising that everyone needs to start somewhere, we are now offering the opportunity for early career researchers to build their reviewing experience with IOP Publishing. As somewhat of an experiment, we are encouraging those in the early stages of their research career (postdocs or those working in an independent research position with less than five years' experience) to register with us, and we will have them review appropriate manuscripts alongside a more experienced reviewer. We hope that this will lead to an increase in diversity amongst our database of contacts and help to build reviewing expertise within two of our newer subject communities. See <http://iopscience.iop.org/page/early-career-reviewers> for more information on this programme.

Addition of Mx title on manuscript submission system

Our manuscript submission system has "title" as a required field for user accounts (for example, Dr, Professor, Mr, Mrs), so that we can be sure we are addressing our users appropriately. A recent suggestion from an anonymous author was that we include an option for users to identify as Mx, a gender-neutral term that may be useful for those who have not yet attained doctor or professor status. This has now been implemented on our submission system and we hope that this offers users a means of feeling more included and represented. It should be noted that we do not include author titles in any published manuscripts.

Reminder to reviewers to update their user account

We noted earlier in this report that it is recommended practice at IOP Publishing to only invite reviewers that have obtained their PhD. As such, we are reliant on users to keep their account up to date, so that we are able to invite them to review if appropriate, as well as correctly reporting on their institution and country. We are now planning to do a campaign to users once a year encouraging them to update their account details to support our strategy to be more inclusive.

Encourage authors and reviewers to sign up for ORCID

Before inviting someone to review for us we will often investigate their publication history and background, to check that they have the right areas of interest and expertise. This can prove very difficult for users with incomplete name records or common names (Bohannon, 2016). In 2017, we signed the ORCID Open Letter and now require ORCID identifiers for all corresponding authors submitting their work to IOP Publishing-owned journals (IOP Publishing, 2017).

Consider double-blind review on more of our journals

Our experiment with double-blind peer review in 2017 proved successful, and those who selected this model did so believing that it was less prone to discrimination or biases. We have therefore decided to offer a double-blind option on two more of our journals in 2019: *New Journal of Physics* and *Physica Scripta*.

Creation of an internal diversity and inclusion statement on peer review

We have created an internal document (see Appendix B, p30) for staff to consult should they be unsure of our company approach to diversity and inclusion in peer review. We hope this will keep us on track in our mission to improve.

5. Limitations

We fully acknowledge that there are several limitations in the data presented in this report. The analysis is undertaken assuming that the sample is representative of the whole data set, and as our user data is often self-reported, there is a high risk of duplicates and out-of-date information being held. Only 40% of our contacts were able to be gendered as we don't collect demographic information on our users, and we are aware that some of our users will not identify with either mainstream gender. Geographical information is based on the self-reported affiliation of users and may not reflect their country of birth or the nationality that they identify with.

6. Conclusions

Reviewing the gender and geographical data of our authors, reviewers and Editorial Board Members has shown that there is progress being made, with submissions from female corresponding authors on the increase and generally good gender representation on our Editorial Boards. There is however, still considerable room for improvement in almost every other respect. Women have less chance of having their papers accepted in half our subdisciplines and are not invited often enough to review papers. There is significant over-representation from the US and Europe, both in Editorial Boards and reviewer invitations. Countries that are growing rapidly in research output, such as China and India, are under-represented on our Boards, and researchers from these countries are not proportionally invited to review as often as researchers from more established Western countries, despite them being more likely to agree to report.

While we can attempt to come up with reasons for the disparities above, none of this analysis proves any causal relationship. This means that the recommendations we make in this report are also not a guarantee of any improvement, however we are keen to do everything we can to make IOP Publishing's peer review as representative as possible.

The recommendations that we put forward are in the main easy to implement and many are already in place. As publishers, we have a responsibility to ensure that our authorship, peer reviewers and Editorial Board Members are reflective of the communities that we serve, and we welcome suggestions and questions from anyone interested in helping us achieve these goals. We hope that the changes we are making will contribute to a richer, more diverse peer-review experience for all.

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8. Appendix

A: Which journals are included in the dataset?

- 2D Materials
- Biofabrication
- Bioinspiration & Biomimetics
- Biomedical Materials
- Biomedical Physics & Engineering Express
- Classical and Quantum Gravity
- Convergent Science Physical Oncology
- Electronic Structure
- Environmental Research Letters
- European Journal of Physics
- Flexible and Printed Electronics
- Inverse Problems
- Journal of Breath Research
- Journal of Geophysics and Engineering
- Journal of Micromechanics and Microengineering
- Journal of Neural Engineering
- Journal of Optics
- Journal of Physics A: Mathematical and Theoretical
- Journal of Physics B: Atomic, Molecular and Optical Physics
- Journal of Physics: Communications
- Journal of Physics: Condensed Matter
- Journal of Physics D: Applied Physics
- Journal of Physics G: Nuclear and Particle Physics
- Journal of Radiological Protection
- JPhys Energy
- JPhys Materials
- JPhys Photonics
- Materials Research Express
- Measurement Science and Technology
- Methods and Applications in Fluorescence
- Modelling and Simulation in Materials Science and Engineering
- Multifunctional Materials
- Nano Futures
- Nanotechnology
- New Journal of Physics
- Nonlinearity
- Physical Biology
- Physics Education
- Physica Scripta
- Physics in Medicine & Biology
- Physiological Measurement
- Plasma Physics and Controlled Fusion
- Plasma Research Express
- Plasma Sources Science and Technology
- Quantum Science & Technology
- Reports on Progress in Physics
- Semiconductor Science and Technology
- Smart Materials and Structures
- Surface Topography: Metrology and Properties
- Superconductor Science and Technology
- Translational Materials Research

B: IOP Publishing Diversity and Inclusion statement for publishing and production

Guiding principles: publishing and production services

- As a leading international science publisher, we are committed to making progress on diversity and inclusion across all of our programmes.
- We will analyse, challenge and continuously improve our working practices to provide a fair and accessible service to all constituents of our diverse customer base.

Our goals

- Recognise the importance of diversity and inclusion at the highest level, evidenced by senior-management ownership and commitment.
- Promote a collective approach to diversity and inclusion in our publishing teams, with working practices and individual objectives to support this.
- Use meaningful data and consultation to understand our customers' needs and to inform evidence-based decision-making on diversity and inclusion issues.
- Monitor and measure the impact of our diversity and inclusion initiatives.

Continuous improvement: a proactive approach to diversity and inclusion

We have a project-led approach to achieve our diversity and inclusion goals. Activities include:

- Regular review of diversity across our journal Editorial Boards and advisory panels.
- Ongoing evaluation of diversity across our content commissioning programmes (journals, ebooks, journalism and conference publishing).
- A proactive, training-led approach to address the challenges of implicit bias in peer review.
- Quantitative analysis of our author and reviewer networks on a number of diversity measures.

Governance

IOP Publishing's Diversity and Inclusion Programme is overseen by the Senior Publishing Management Team with guidance and support from the Institute of Physics' Diversity and Inclusion Committee.